

CLAIMS

What is claimed is:

A packaged food product comprising:

a food product;

a package enclosing the food product, the package comprising a coated, printed film comprising:

a substrate film comprising one or more thermoplastic materials, the substrate film having a print side and an opposing food side and an average thickness of less than about 15 mils;

an image printed on the print side of the substrate film;

a radiation-cured varnish over the printed image, the radiation-cured varnish formed by:

coating the printed image with a radiation-curable varnish comprising one or more polymerizable reactants and optionally one or more photoinitiators; and

subsequently exposing the radiation-curable varnish to radiation sufficient to polymerize at least 90 weight % of the one or more polymerizable reactants;

wherein when the coated, printed film is tested according to the FDA migration test protocol, no more than 50 parts per billion total of any of the polymerizable reactants and the optional photoinitiators migrate within 10 days at 40°C from the coated, printed film into a food simulant selected from the group consisting of i) 95 weight % ethanol and 5 weight % water and ii) 5 weight % ethanol and 95 weight % water, the food simulant enclosed within a test container formed from the coated, printed film so that the food simulant contacts the food side of the substrate film and the ratio of volume of food simulant to surface area of coated, printed film is 10 milliliters per square inch.

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2. The packaged food of claim 1 wherein:
the package comprises one or more heat-sealed regions;
at least a portion of the radiation-cured varnish extends into the heat-sealed region; and

5 the weight of the radiation-cured varnish per unit area of substrate film in the portion of the radiation-cured varnish extending into the heat-sealed region is at least substantially equal to the weight of radiation-cured varnish per unit area of substrate film outside of the heat-sealed region.

10 3. The packaged food of claim 1 wherein:
at least a portion of the printed image extends into the heat-sealed region; and
the weight of printed image per unit area of substrate film of the portion of the printed image extending into the heat-sealed region is at least substantially equal to the weight of printed image per unit area of substrate film outside of the heat-sealed region.

15 4. The packaged food of claim 1 wherein:
the package further comprises one or more heat-sealed regions;
the gloss of the coated, printed film in the heat-sealed regions is at least substantially equal to the gloss of the coated, printed film outside of the heat-sealed regions.

20 5. The packaged food of claim 1 wherein the coated, printed film is capable of being exposed to 60 psig of contact pressure between the radiation-cured varnish and an aluminum foil for 2 seconds at a temperature of at least 250°F with less than 5 weight % of the printed image being transferred to the foil.

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Sub 6. The packaged food of claim 1 wherein the substrate film comprises one or more of the polymers selected from the group consisting of polyvinyl alcohol, acrylonitrile-butadiene copolymer, isobutylene-isoprene copolymer, polyacrylonitrile, polyvinylidene chloride, highly crystalline polyamide, highly crystalline polypropylene, and highly crystalline polyethylene.

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7. The packaged food of claim 1 wherein the substrate film has an average thickness of less than about 5 mils.

8. The packaged food of claim 1 wherein the printed image is formed by applying one or more water- or solvent-based inks to the print side of the substrate film and drying the one or more inks.

9. The packaged food of claim 1 wherein the printed image is free of photoinitiator.

10. The packaged food of claim 1 wherein the printed image is formed by applying one or more radiation-curable inks to the print side of the substrate film and curing the one or more inks.

11. The packaged food of claim 1 wherein the package enclosing the food product comprises a vertical form-fill-sealed package.

12. The packaged food of claim 1 wherein the package enclosing the food product includes a lid comprising the coated, printed film.

13. The packaged food of claim 1 wherein the radiation-cured varnish of the coated, printed film has an average gloss of at least about 80% measured in accordance with ASTM D 2457 (60° angle).

5 14. The packaged food of claim 1 wherein the coated, printed film has an average gloss of at least about 80% measured in accordance with ASTM D 2457 (60° angle), has a crinkle test rating of at least 4, and can withstand at least 150 double rubs under the NPAC rub test without break in the printed image.

10 15. The packaged food of claim 1 wherein the average thickness of the radiation-cured varnish of the coated, printed film is less than about 5 micrometers.

16. The packaged food of claim 1 wherein the radiation-curable varnish includes less than 20 % monofunctional monomer based on the weight of the radiation-curable varnish.

17. The packaged food of claim 1 wherein the radiation-curable varnish includes less than 20 % reactant diluent based on the weight of the radiation-curable varnish.

18. A packaged food product comprising:

20 a food product;

a package enclosing the food product, the package comprising a coated, printed film comprising:

25 a substrate film comprising one or more thermoplastic materials, the substrate film having a print side and an opposing food side and an average thickness of less than about 15 mils;

an image printed on the print side of the substrate film;

a radiation-cured varnish over the printed image, the radiation-cured varnish formed by:

5 coating the printed image with a radiation-curable varnish comprising one or more polymerizable reactants and optionally one or more photoinitiators; and

subsequently exposing the radiation-curable varnish to radiation sufficient to polymerize at least 90 weight % of the polymerizable reactants;

wherein the package comprises one or more heat-sealed regions and at least a portion of the radiation-cured varnish extends into the heat-sealed region; and

10 wherein the weight of the radiation-cured varnish per unit area of substrate film in the portion of the radiation-cured varnish extending into the heat-sealed region is at least substantially equal to the weight of radiation-cured varnish per unit area of substrate film outside of the heat-sealed region.

15 19. The packaged food of claim 18 wherein:

at least a portion of the printed image extends into the heat-sealed region; and

the weight of printed image per unit area of substrate film of the portion of the printed image extending into the heat-sealed region is at least substantially equal to the weight of printed image per unit area of substrate film outside of the heat-sealed region.

20 20. The packaged food of claim 18 wherein the gloss of the coated, printed film in the heat-sealed regions is at least substantially equal to the gloss of the coated, printed film outside of the heat-sealed regions.

25 21. The packaged food of claim 18 wherein the coated, printed film is capable of being exposed to 60 psig of contact pressure between the radiation-cured varnish and an

aluminum foil for 2 seconds at a temperature of at least 250°F with less than 5 weight % of the printed image being transferred to the foil.

22. A packaged food product comprising:

5 a food product;

a package enclosing the food product, the package comprising a coated, printed film comprising:

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a substrate film comprising one or more thermoplastic materials, the substrate film having a print side, an opposing food side, and an average thickness of less than about 15 mils;

an image printed on the print side of the substrate film;

a radiation-cured varnish over the printed image, the radiation-cured varnish formed by:

15 coating the printed image with a radiation-curable varnish comprising one or more polymerizable reactants; and

subsequently exposing the radiation-curable varnish to an electron-beam radiation source having an energy of less than about 100 keV in an amount sufficient to polymerize at least 90 weight % of the polymerizable reactants.

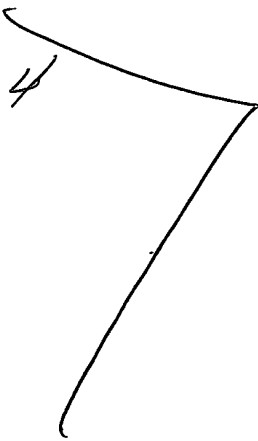
20 23. The packaged food of claim 22 wherein the radiation-cured varnish is formed by exposing the radiation-curable varnish to an electron beam radiation source having an energy of less than about 75 keV.

25 24. The packaged food of claim 22 wherein the radiation-curable varnish includes less than 20 % monofunctional monomer based on the weight of the radiation-curable varnish.

25. The packaged food of claim 22 wherein the radiation-curable varnish includes less than 20 % reactant diluent based on the weight of the radiation-curable varnish.

5 26. The packaged food of claim 22 wherein the radiation-curable varnish is cured by a free radical mechanism.

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